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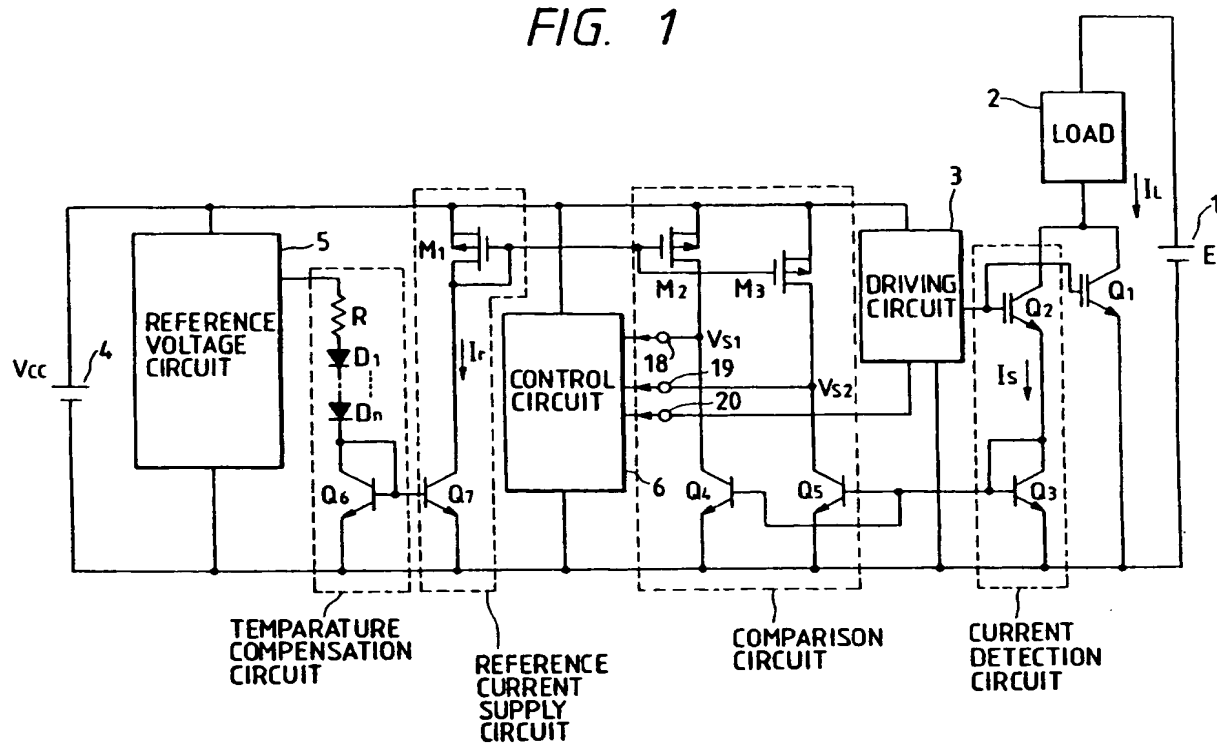
EUROPEAN PATENT APPLICATION(21) Application number: **91118397.8**(51) Int. Cl.⁵: **H02M 7/537, H02H 3/087,
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17.03.93 Bulletin 93/11(71) Applicant: **HITACHI, LTD.
6, Kanda Surugadai 4-chome
Chiyoda-ku, Tokyo 100(JP)**(72) Inventor: **Miyazaki, Hideki
1-19-4-403, Ishinazaka-cho
Hitachi-shi, Ibaraki-ken(JP)
Inventor: Watanabe, Kouzou
1-12-44, Minamikouya-cho****Hitachi-shi, Ibaraki-ken(JP)****Inventor: Onda, Kenichi****2-18-3, Daihara-cho****Hitachi-shi, Ibaraki-ken(JP)****Inventor: Tanaka, Tomoyuki****6-5-5, Omika-cho****Hitachi-shi, Ibaraki-ken(JP)****Inventor: Sakurai, Naoki****6-20-3, Ayukawa-cho****Hitachi-shi, Ibaraki-ken(JP)****Inventor: Mori, Mutsuhiro****1-19-4-203, Ishinazaka-cho****Hitachi-shi, Ibaraki-ken(JP)**(74) Representative: **Altenburg, Udo, Dipl.-Phys. et
al****Patent- und Rechtsanwälte****Bardehle-Pagenberg-Dost-Altenburg****Frohwitter-Geissler & Partner Postfach 86 06****20****W-8000 München 86 (DE)**(54) **Current detection circuit of power semiconductor device and power converter using the circuit.**

(57) According to the invention different detection levels of a load current can be detected. Preferably, these detection levels are an overcurrent control level and/or a constant current control level. Said constant current control level can be a constant current value associated with chopper control or a value which judges an overload when a chopper control current exceeds a predetermined current level beyond a predetermined number of times. Said overcurrent control level can be a value corresponding to short-circuit-protection.

Further, according to the invention a control circuit can control power semiconductor devices by decreasing a control voltage in a plurality of steps to zero in the case where an overcurrent detecting circuit outputs a detection signal corresponding to an overcurrent control level.

According to a further aspect of the invention a power converter with a plurality of semiconductor devices is improved by control means and current detection circuits showing the above mentioned advantages of the invention.

FIG. 1





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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 8397

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 149 749 (MOTOROLA) * abstract; figure 1 * ---	1-5	H02M7/537 H02H3/087 G01R19/165 H03K17/08
A	EP-A-0 010 980 (FUJITSU FANUC) * claims 1,2 * ---	1,9,10, 16,17	
A	RESEARCH DISCLOSURE January 1990, NEW YORK page 80 'Active 10 AMP current limit circuit for smartpower applications' * the whole document * ---	1,9,10, 16-18	
X	EP-A-0 392 831 (GENERAL ELECTRIC) Y * column 4, line 29 - line 48; figure 1 * ---	11,13 14	
Y	EP-A-0 361 211 (SIEMENS) * abstract; figure 1 * ---	14	
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 190 (E-918)(4133) 18 April 1990 & JP-A-23 7 828 (FUJI) 7 February 1990 * abstract * -----	11-15	TECHNICAL FIELDS SEARCHED (Int. Cl.5) H02M H02H G01R H03K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 JANUARY 1993	Examiner GENTILI L.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,
namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,
namely:

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- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,
namely claims:
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,
namely claims:



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LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-10, 16-18: A current detection circuit, comprising a comparison circuit, a reference current supply circuit and a detection current extraction circuit, for detecting different detection levels of a load current.
2. Claims 11-15: A control circuit for power semiconductor devices, comprising an overcurrent detecting circuit and voltage decreasing means for decreasing the control voltage of said power semiconductor devices.